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ROY WALDO MINER

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BY
ABRAHAM GREENFIELD

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ABRAHAM GREENFIELD*

In 1924, Jones[4] performed the now classic experiment of eliminating a child's fear of a rabbit by counterconditioning, *i.e.*, by introducing the stimulus feared in a mild form while the child was engaged in a pleasurable response, eating, in the presence of an adult with whom it felt secure. The stimulus was moved closer every day until eventually the child lost all fear of the rabbit. Following this, fear responses to generalized objects such as cotton or furs were completely gone.

Fear may spread in two ways: (1) by generalization to objects with characteristics similar to the fear-provoking stimulus; and (2) by conditioning to cues present at the time of this original stimulus. If extinguishing the fear of the original frightening agent or experience can remove fear of generalized stimuli, why cannot it also remove fear of cues present at the time? Such conjecture would amount to assuming that conditioning could be considered as one form of generalization, namely temporal generalization. Miller[6] did this when he extended the definition of "nearness" to apply to nearness in "space, time or some dimension of qualitative or culturally defined similarity of cues." This extension has support from Diven's[2] experiment in which both temporal and meaning generalization took place. A shock 12 seconds after the word "barn" resulted in high galvanic skin responses (GSR) to rural words and to words before and after the shock word.

From a Darwinian viewpoint, responses to conditioning and to stimulus generalization are equally valuable as anticipatory to drive reduction. Furthermore, any extension of a definition is worth while if it is operational. Hence the present experiment testing the hypothesis: elimination or weakening of a fear response to an unconditioned stimulus by a process of adaptation should make the subsequent extinction of fear response to a conditioned stimulus rapid and permanent.

That fear of even a strong unconditioned stimulus (UCS) such as electric shock can be eliminated by counterconditioning was shown by Pavlov.[12] He gave hungry dogs gradually increasing shock as a conditioned stimulus (CS) to food. Eventually even the physiological responses to electric shock disappeared. More recently, Muenzinger[11] adapted rats to tolerate severe shock by rewarding them as they received gradually increasing shock. A modification of Muenzinger's apparatus was used in this experiment.

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In Jones's experiment the presence of the child's mother was regarded as essential. Muenzinger's success in adapting rats by means of reward alone to more than twice the shock given in the training period proved this to be sufficient in the case of the rat.

Experimental Design

Fear of a CS, a white rectangular box, was developed in rats by electric shock. A pretest of avoidance of this white box was then made in order to match pairs by latency in running toward this feared box containing food. Using a differently shaped apparatus, one of each pair was adapted to shock by counterconditioning. The subjects learned to press a lever to give themselves shock and a food reward. Current was begun at a very low level and gradually increased to the maximum previously used in developing the conditioned response (CR). Control rats received the same treatment with the exception of shock. After adaptation of experiment (E) rats, E and control (C) rats were compared in fear of CS by permitting them to run a T maze with one choice to the feared box, and the other to a neutral box of different color and shape. This was done under three different conditions of re-enforcement. The criterion of fear was avoidance of the white box.

Procedure

Subjects. The experiment was begun with 16 female albino rats approximately 120 days old. Only eight rats completed the final stage of the experiment. Some were discarded when they showed extreme fear of the experimenter after biting him. Some would not enter the adaptation apparatus and, if forced in, would refuse to eat, and do nothing but scramble up the walls. One rat would eat but never learned to shock itself to get food, remaining frozen till a pellet of food appeared. Another never went past the swinging doors at the choice point in the T maze. The weights of the rats averaged from 175 to 215 grams.

Apparatus. The conditioned fear response was developed by shocking the rats in a white rectangular wooden box with a grid floor and a wire screen lid, and a guillotine type door on one side. The inner dimensions of the box were 10 inches high by 6 in. by 8 in. The grid was made of 1/8-in. brass rods spaced at 3/8-in. intervals. The shocking current was half-wave 60-cycle current through a 6SJ7 tube with a 300,000-ohm rheostat in the cathode circuit to vary the current from 0 to 100 microamperes.

The preliminary test for matching purposes was done in two straight 24-in. runways, one with the box in which the subjects had been shocked as goal box (GB), and the other with a neutral goal box made from a black cylindrical wire cage 8 in. in diameter with an opaque lid and a smooth floor. Differently shaped food trays were in each GB. Each runway and starting box was the same color as its goal box. The floor of the white runway was made of ridged rubber to resemble a grid floor, whereas the black floor was smooth. String-operated guillotine-type doors separated the goal boxes and starting boxes from the runways. The runways pointed in opposite directions, each on a separate table with 22 in. between the tables for the experimenter.

The adaptation apparatus had a grid floor consisting of two solid brass strips 15 in. by 1 7/16 in. placed parallel but at an angle to each other to make a shallow trough with 1/4-in. space between them and resulting in an over-all floor dimension of 15 in. by 3 in. The walls were 12 in. high and made of wood with the exception of the front removable glass plate, 15 in. by 12 in. A starting box on one side opened into the apparatus through a guillotine-type door. In the other side wall, 4 in. above the floor, was a lever which could be operated by the subject from the inside, or by the experimenter from the outside, to turn on the shock current. A relay circuit kept the shock on till it was turned off by the pressing of a break key by the experimenter (E). A small 6-volt lamp lit up and stayed lit as long as the current was on. The shocking apparatus described previously was also used for the adaptation with the rheostat giving control of current strength. A food tray 1-in. square was located 2 in. below the lever. Food was dropped by E into the tray through a hole in the side wall just above the tray.

The final test was conducted in a cross maze, shown in FIGURE 1, described fully by Montgomery.[8] The goal boxes previously described, were added to the goal arms, so that rats could choose either the white GB in which they had been first fed and then shocked, or the black GB in which they had only been fed. The other cross piece had a starting box at each end. In actual use, the cross maze was a T maze because either one of two sliding doors between the starting arms and choice point was always closed. The starting arms were only 2 in. in width to eliminate wall-following tendencies. One-way swinging doors led to the goal arms from the choice point. These were made of 1/8-in. lucite. The goal arm leading to the white "feared" box was lined with white painted pliofilm, the one to the neutral back goal cage with black, and the starting arms were lined with gray. Illumination was from a 40-watt bulb in a ceiling reflector directly over the choice point. The experimenter stood behind one starting box (SB).

Pretraining. The rats were put on a one-hour feeding schedule five days before the experiment began. The sixth day was spent with the animals learning to run the preliminary test apparatus. The experimenter stood between the two runways transferring each subject (S) from the GB of one runway to a waiting cage to the SB of the other runway. Pretraining was begun by putting the rat into the white BG and allowing it to eat three pellets of Purina laboratory food. The rat was then transferred to the white SB and allowed 15 seconds to explore. The door was raised and as soon as all four feet of S were past the doorway, an electric timer was started. As soon as all four feet were in GB, its door was lowered and the timer stopped. Five seconds after eating the single pellet previously placed in the food tray, S was transferred to a waiting cage (a clean waste can) for three minutes before being placed in the SB of the black runway for a trial there. In a similar manner, S was transferred from the black GB to the white SB for another trial there. Each rat was given four such cycles for a total of eight reinforcements. Running times were used to plot learning curves in order to investigate any possible initial preferences.

Training. The purpose of the training was to develop in all the

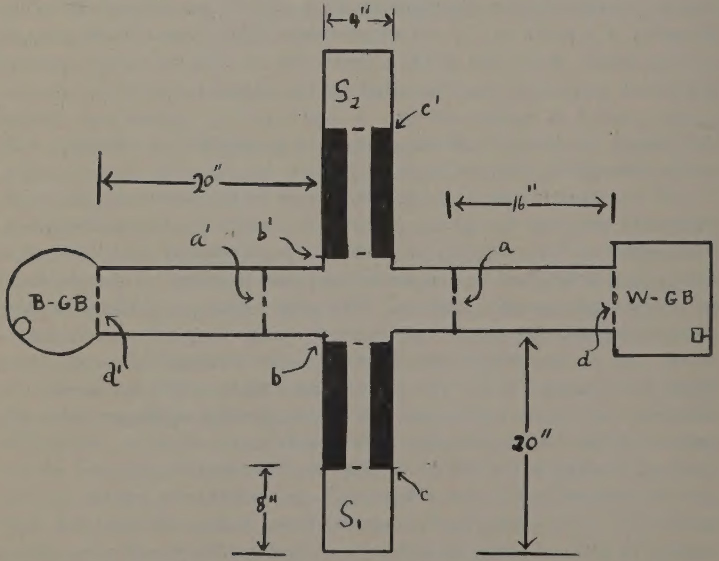

FIGURE 1. Diagram of the final test apparatus. S_1 and S_2 are the two starting boxes; B-GB is the black neutral goal box, and W-GB is the white "feared" goal box; *a* and *a'* are one-way doors; *b* and *b'*, c and c' are sliding doors; *d* and *d'* are guillotine-type doors. All dimensions are inside dimensions.

subjects a conditioned fear response to the white rectangular box. On the first day of training, each rat was placed in the white starting box and permitted to run to the white GB, as in pretraining, but with no reinforcement. After an exploratory period of 20 seconds, the rat received three brief shocks of 40 microamperes given in rapid succession by E pressing a key quickly up and down. This was repeated at 10-second intervals for a total of four sets of shocks. Immediately after the last shock, S was removed by opening the top lid, and transferred to a waiting cage for 5 minutes before being put into the feeding cage. The second day, S was placed directly into the white box through the side door and the shock was increased to four rapid brief 45-microampere shocks repeated at 10-second intervals for a total of six sets of shocks. The third day, Ss received five brief shocks at 50 microamperes for a total of eight sets of shocks. All rats squealed and scrambled at least once during each series.

Pretest. The purpose of the pretest was to permit matching of pairs on the basis of speed in running to feared and neutral goal boxes. The two runways were used as in pretraining. Each S was started in the black SB to encourage running tendencies, and the procedure, from then on, was exactly as in pretraining except that only three cycles were run to prevent too much extinction. If a rat did not enter the goal box in 60 seconds, it was removed from the runway through the top and put directly into the waiting cage. Learning curves were drawn from these data, and rats with curves that were most alike henceforth became pairs, living in one cage, and handled and run successively, but alternately each day. One of each pair became a member of the experimental group and the other a member of the control group, the choice being decided at random.

Retraining. Because some extinction of the fear of the white box had taken place during the pretest, all Ss were given another day of shock, this time six brief 60-microampere shocks for eight sets of shocks at 10-second intervals.

Adaptation. To produce adaptation by counterconditioning, E rats were given a series of gradually increasing shocks followed by reinforcement, each shock being terminated as soon as the rat grasped the pellet of food. Rats soon learned to press the lever which brought shock and food. The procedure during each day was as follows: each E rat was given 15 seconds in SB, the entrance door was raised, and S was permitted to run to the other end of the apparatus to find a pellet of food in the tray beneath the lever. If S did not press the lever by random movement within 60 seconds after eating the first pellet, then E operated the lever from the outside. A relay clicked and E dropped a pellet of food into the tray through the hole in the wall. No shock was given during the first four of the ten trials of the first day. Trials 5 to 10 were given a shock of 5, 10, 15, 20, 20, 0 microamperes respectively. Current was broken by E pressing a break key as soon as S grasped the food, thus facilitating learning to look for food at the moment of shock. On the second day, current was varied as follows: 0, 5, 10, 15, 20, 25, 25, 25, 10, 0 microamperes. Each day, the first and last trials were given no shock, but all other trials were given a shock 5-microamperes higher than on the previous day. Most subjects learned to press the lever to give themselves shock and food, one so rapidly it was difficult for E to supply a pellet, press the break key, and turn the rheostat fast enough. Pellets of food were cubes of doughnut approximately 3/16 in. on a side. After the last trial each day, the front glass panel was lifted and S was removed to a waiting cage for 5 minutes and thence to a feeding cage. The highest level of shock reached on the ninth and last day of adaptation was 60 microamperes, the same as the highest level reached in training. Control rats were treated exactly as E rats except that they received no shock in this apparatus. Pairs were run in the order E_1,C_1,C_2,E_2, *etc.*, followed the next day by the order C_1,E_1,E_2,C_2, *etc.*

Final Test. The cross maze, operated as a T maze was used to determine any difference between E and C rats in avoidance of the "feared" white box. On the first three days of the testing procedure, trials were reinforced regardless of which GB was entered. There were eight trials the first two days, and 10 trials the third day. The hypothesis would be confirmed if the counterconditioned rats showed no fear of the white box by choosing it as often as the neutral black box. The fourth day, reinforcement occurred only in the white box to compare learning of the two groups in eight trials. On the fifth day, no food was available with either choice, to test extinction in 10 trials. According to Montgomery,[7] a maximum of spontaneous alternation is encouraged by having narrow starting arms and by the use of a 10-second intertrial. Although these factors were part of the design, some turning habits developed the first day. Hence, starting with the second day, any S which made three successive turns in one direction was started from the opposite SB so that the same turning would lead it to the opposite GB.

The procedure in detail was as follows: each rat was placed in SB and allowed to explore for 30 sec. Then the sliding door was opened and S could run down the starting arm, make its choice past a one-way swinging door, enter GB and eat for 5 seconds. After eating, S was immediately transferred to SB for another trial. But for this and all subsequent trials only 10 seconds exploratory time was permitted in SB to encourage a maximum of spontaneous alternation. After the last trial of

TABLE 1

NUMBER OF TIMES EACH RAT CHOSE THE "FEARED" BOX

	E_1	C_1	E_2	C_2	E_3	C_3	E_4	C_4	E_t	C_t	
First day—of 8 trials	4	2	4	0	4	2	5	0	17	4)	Reinforcement
Second day—of 8 trials	5	3	3	1	5	2	5	1	18	7)	for either GB
Third day— of 10 trials	7	4	6	1	6	3	7	2	26	10)	
All 3 days—of 26 trials	16	9	13	2	15	7	17	3	61	21	
Fourth day—of 8 trials	7	5	4	2	7	4	6	3	24	14	Learning
Fifth day—of 10 trials	7	5	7	1	7	5	6	4	27	15	Extinction
All 5 days—of 36 trials	30	19	24	5	29	16	29	10	112	50	

each day, S was transferred to a waiting cage for five minutes and thence to a feeding cage.

Results

The outcome of the test procedure in the T maze is summarized in TABLE 1, where the number of times each S chose the white feared box is listed for the first three days, when reinforcement was in either box, totals for all five days, and totals for all Es and all Cs on each day.

FIGURES 2 and 3 summarize the scores of TABLE 1 in percentages of choice of the feared box during the first three days when reinforcement was in either GB. FIGURE 2 compares all Es with all Cs for each day. FIGURE 3 compares each E with its matched C for all three days. Data on both indicate (1) avoidance of the white box by all controls and on all days; (2) approximate random action or 50 per cent choice of the white box by E rats, resulting in a marked difference between E and C rats. That the avoidance by the controls is significantly different from chance is shown by t values in the column "C versus chance" of TABLE 2. All but one value of P is <.01, the exception for day 3 being <.02. The column "E versus C" of the same table shows that differences between E and C rats are all significant at well below the .01 level. Since pairs were matched, we have additional confidence that, after training, E rats would have shown the same avoidance of the CS as the C rats. Hence results show that adaptation to UCS by counterconditioning permits rapid extinction of the avoidance of the CS. Furthermore, since random

TABLE 2

	C vs. chance			E vs. C		
	t	d.f.	P	t	d.f.	P
First day	5.22	3	<.01	4.25	6	<.005
Second day	4.71	3	<.01	5.50	6	<.001
Third day	3.86	3	<.02	6.91	6	<.001
All 3 days	4.80	3	<.01	6.32	6	<.001

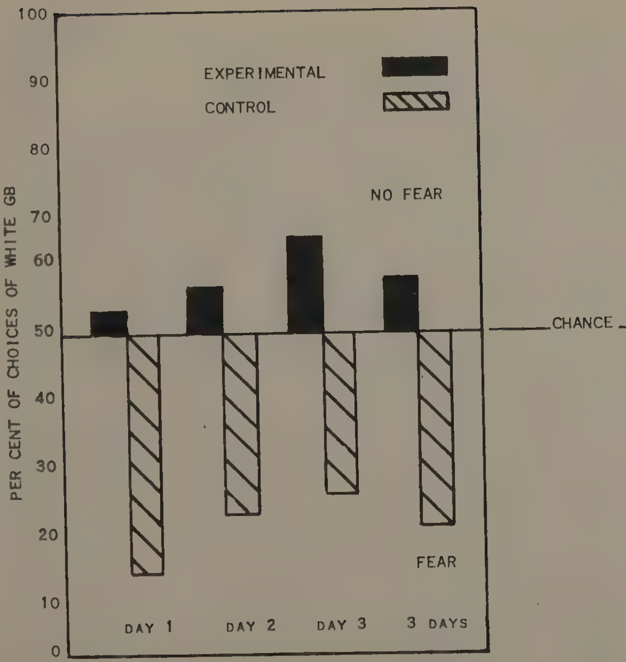

FIGURE 2. Per cent choice of white GB on each day for all E and C rats.

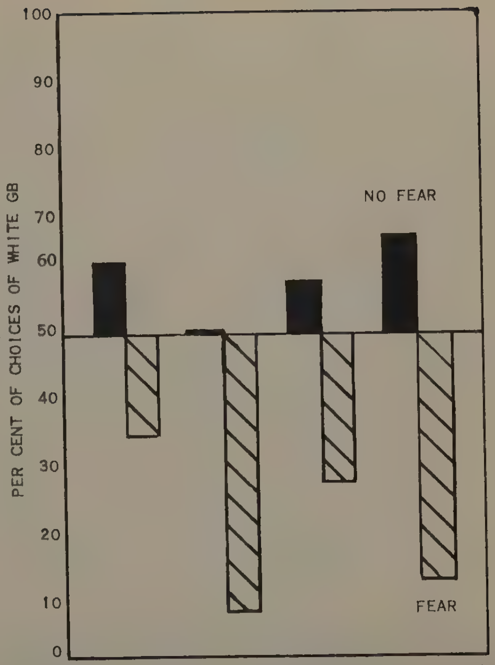

FIGURE 3. Per cent choice of white GB by each pair for three days.

choice shows more "normalcy," then no preference for either GB for *each* of three days indicates even more likelihood of "normalcy" than a mere average of no preference over three days.

Since the experimental conditions were most favorable to spontaneous alternation, "normal" behavior should show a higher percentage of alternation. Scores for the first day showed 20 alternations (71 per cent) for E rats and only 7 (25 per cent) for controls. The difference was significant below the .01 level (t of 3.32). The figure of 71 per cent is remarkably close to the figure of 69 per cent alternation found by Montgomery[7] as the percentage of alternation for this intertrial interval. Alternation could not be scored the next two days because, on those days, Ss were shifted from one starting box to the other whenever three repetitions occurred. Such shifting was done a total of 10 times to the C rats to break up turning tendencies to the black neutral GB and, incidentally, was successful 8 out of 10 times in getting S into the white runway (however, in 7 out of these 8 cases, on the next trial, S returned to its choice of the "safe" box). Out of these eight times that C rats were tricked into the white runway, the white GB was entered and food eaten six times. Once the pellet was not eaten, and once S would not enter the white GB and was removed from the runway after 60 seconds. One E rat that did not go past the one-way doors at the choice point till it was replaced into SB twice, developed a left-turn habit that resulted in a change of SB to break up repetitions of both choices. The other three E rats showed no repetitions to the neutral GB. If this procedure of breaking up turning habits had not been used, the differences between E and C rats, and between C rats and chance would have been even higher.

A difference between E and C rats was also noted on the very first trial in the number of times Ss explored left and right runways up to the one-way doors, before making their choice. E rats made 30 such VTEs, C rats made 20. The difference, however, was significant only at the .05 level (t of 2.02). Apparently the rats that retained their fear found less exploration necessary before a decision of avoidance was made.

Results of the fourth and fifth days show behavior under conditions of learning and extinction. On the fourth day, comparison was sought between E and C rats in learning to find reinforcement only in the white box. On the fifth day, learning was extinguished by offering no reinforcement for either choice. TABLE 1 gives the data on choice of the white box during these two days. Score differences of the fourth day give a very high t of 8.6. The fifth day, P is very close to .01 (t of 3.00). These scores were changed to percentages of choice and used to draw curves of learning and extinction, shown in FIGURE 4. Points on the learning

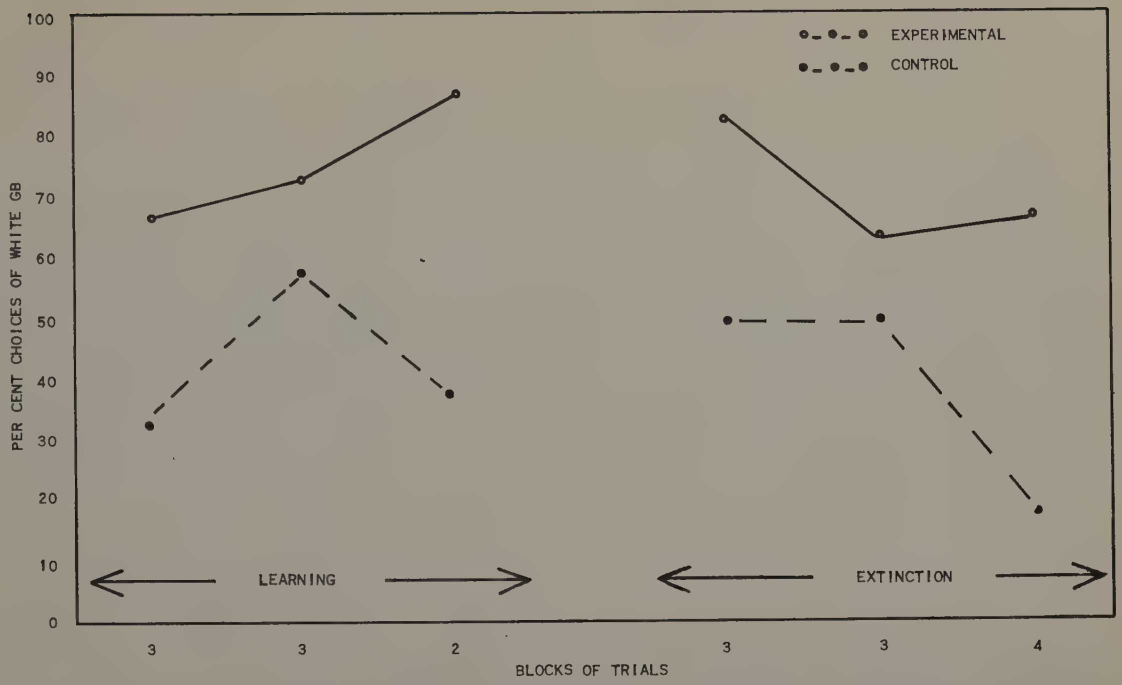

FIGURE 4. Per cent choice of white GB in eight trials of learning to reinforcement in white GB, and in ten trials of extinction to reinforcement in neither GB.

curve represent blocks of three trials, three trials, and two trials. Points on the extinction curve represent blocks of three, three, and four trials. Values for learning and extinction differences were not significant ($P<.1$) but trends are in support of the hypothesis. Counterconditioned rats showed the usual rise of learning followed by the fall to chance levels in extinction. Controls in learning began with a rise, but followed with a fall as if the avoidance gradient overcame the approach gradient. The next day there was some recovery but extinction resulted in strong avoidance.

Examining the number of alternations towards the end of the extinction runs revealed a significant difference between E and C subjects. In the last six trials, the adapted rats alternated 17 times or 85 per cent of the time, whereas the controls alternated 7 times or 35 per cent of the time, with the difference giving a t of 3.87 and $P<.01$.

An estimate of the accuracy of matching pairs may be had from a rank-order correlation between E and C rats using avoidance to determine rank. Computation gave rho = .80 for the five days total, indicating a high likelihood of good matching.

Discussion

Despite the small number of subjects, the high values of t are strong evidence in support of the hypothesis proposed. So many subjects had to be discarded not only because of unfortunate circumstances, but also, it is felt, because of the use of a particularly active and sensitive strain of rats. A similar experiment was done elsewhere with rats from a strain used by biochemistry, and these were found much less sensitive to extraneous factors. Farber[3] noticed a similar difference between strains bred by different users and gives a very plausible explanation, namely, that biologists tend to breed inactive animals and psychologists would be apt to prefer good runners. Experimenters working with "fear" would do well to choose less active strains unless freezing of animals would be a problem.

It is felt by many that in Jones's experiment, the presence of the mother was essential for the results obtained. Since, in the present experiment, the rats were shocked and counterconditioned by the same E, it appears that no benign figure is necessary for adaptation to take place. The use of doughnut cubes instead of laboratory pellets may have been an important factor. Preliminary tests with other rats in the adaptation apparatus showed conflict, which the more desirable reward helped to resolve favorably. Even with this additional incentive, one rat (not included in scores) never learned to press the lever, but did move forward to eat from the food tray from its somewhat frozen position as soon as E turned on the current. When run through the final test, this S showed a score part way between E and C rats. Some operation by Ss in the adaptation apparatus may or may not be essential, but the lever movement by S was useful in the experimental design in giving E information as to how the rats were responding. Obviously, if the animal will press the lever to give itself a shock, adaptation is taking place. It is possible that this control of the situation aids in development of adaptation. Masserman[5] found that cats could overcome their fear of an air blast more readily if they could control its appearance. It would be worth while determining whether control of the apparatus by the subject is of significant value in efficacy of adaptation.

It was rather surprising to find that the adapted rats did not even show an initial fear of the white box on their first day in the T maze. This may have been due to the fact that they were fed in the white box the day before they were shocked in it. Hence a purer test of the hypothesis would have been to omit the preliminary training and matching of pairs.

Another explanation is possible. Perhaps the association of food with shock gave to shock a sufficiently positive value as a cue that the white box now has some of this positive stimulus value. Transfer from a negative tropism that is not too severe to a positive tropism has been done with many species (especially with light as the stimulus). This hypothesis could be tested by redoing the experiment using a Skinner box, with depression of bar pressing as a measure of fear. If the above explanation is correct, presenting the CS should result not only in no reduction in the rate of bar pressing, but even in increase in the rate.

Is the elimination of a conditioned fear response as produced in this experiment permanent, or does recovery occur? Brady[1] found that a conditioned fear response removed by electroconvulsive shock returned after 30 days and was still present after 90 days. From the analogy between the present experiment and the one by Jones, one would be inclined to guess that the method described in this paper produced permanent elimination of the fear response. But the question as to what would have been the results if the T maze test had taken place 30 days after the adaptation is an open one that could be settled only by further experimentation.

The experiment described here is an analogue to catharsis in its purest form as achieved under hypnosis or narcosis. Here the patient is permitted to re-experience the original trauma in the secure atmosphere of a benign psychiatrist, just as the rats being counterconditioned re-experience the original shock to the accompaniment of a reward.

This experiment is also an analogue of the desensitization of allergic reactions, where gradually increasing doses of the toxic agent enable the organism eventually to withstand large doses of it. The same can be said for anaphylactic reactions and immunization phenomena.

In treating war neuroses, catharsis is found effective most often when instituted shortly after the traumatic experience. It is commonly agreed that the longer a flyer who has crashed remains grounded, the more difficult it will be for him later to return to the air. This apparent reinforcement of fear Mowrer[9] once called "parasitic" reinforcement. With the aid of the two-factor theory of learning. Mowrer now ascribes it to learning reinforced by escape from fear. The analogue of this would be to investigate how effective counterconditioning of the UCS would be in removing a fear if carried out about a month after the establishment of the conditioned fear response. Perhaps an even closer analogue would be to carry out the counterconditioning after some practice in escape from fear had taken place. In the present experiment, this could have been done by adapting the control rats after they had been put through the final test in the T maze, where they had experienced escape from fear when they avoided the white box. A retest in the T maze, to hazard a guess, would probably have shown less effective, if any, removal of the conditioned fear response.

The mechanics of adaptation is of interest to both psychologists and neurologists. Adaptation to innocuous stimuli, such as odors, is regarded as due to nerve fiber fatigue. On the other hand, adaptation to common noises with sensitivity to a meaningful sound amidst these noises (as evidenced by the mother who sleeps through considerable din but awakens to a whimper by her child) requires a more central explanation. Pavlov[12] felt adaptation was entirely neurological, because he found that adaptation to a stress at one spot on the skin could be developed with no transfer to stress applied at some other part of the body (with the exception of the symmetrical point). Do the rats in the present experiment actually feel less pain when shocked after adaptation has taken place, or do they feel it fully but mind it less? This may sound like a very unbehavioristic question, but the alternatives are operationally distinguishable. If the effect is purely one of nerve fibre inactivation, then repetition of shock under central anesthesia should produce considerable adaptation. If the effect is mainly psychological, *i.e.*, if adaptation is due to the central reaction to electric shock now having strong hedonic elements, would "tricking" the rat into this "attitude" result in easier extinction of a conditioned fear response? This could be attempted as follows: instead of gradually raising the current in the adaptation apparatus, it could be started at a high level and gradually lowered, so that subjects would possibly react (in the manner of Tolman's rats), "This shock doesn't amount to much at all, it's just a strong cue for food."

A mild shock, of course, can be an excellent cue to assist learning. Muenzinger[10] showed that rats shocked for choosing the right path to food learned faster than controls not shocked. Not only is mild shock an additional cue, but escape from this shock is an additional reinforcement. This was borne out by the informal observation that the E rats in the present experiment learned the lever movement more rapidly than the controls, which had only the click of the relay as an added cue. It is also possible that the higher level of tension of the E animals, as shown by their more restless activity in the adaptation apparatus, was helpful in learning. During the second day's trials, only the E rats responded to the relay click by a sharp withdrawal movement, so that the relay sound had to be softened the next day by inserting a piece of cardboard between magnet and armature.

If rats actually feel less pain when shocked after adaptation has taken place, then the results of Muenzinger's[11] recent experiment using adaptation would have to be questioned. For he equated, in stimulus effect, shock given to a group of rats after adaptation, with an equal intensity of current given to control rats, whereas these equal shocks may very well have had different stimulus value for the two groups.

Since some adaptation occurs from mere repetition of shock without any reward, the question arises as to whether this would produce a lessening of fear of a CS also. This would amount to continuation of UCS without CS to produce extinction of CR, instead of the opposite, which is the usual method. No example of this being done directly could be found in the literature. It is surprising that those who think in Pavlovian terms of strengthening and weakening of new connections did not design such an experiment. However, Pavlov furnishes us with indirect evidence that this type of extinction is possible when, in changing from one CS to a second, response to the first is extinguished.

Summary

This experiment was done to test the hypothesis that adaptation to a UCS by counterconditioning would result in rapid extinction of a fear response to a previously conditioned stimulus. The CS was a white rectangular wooden box in which all subjects were shocked. After a preliminary test to match pairs, one of each pair was adapted to electric shock in a different apparatus by rewarding S with food to gradually increasing shock. The maximum current reached was the same as the maximum used in producing the fear response. Ss learned to press a lever to give themselves shock and food. Controls were given the same

treatment with the exception of shock. All subjects were then tested for avoidance response in a T maze with the feared box as one choice and a neutral black cylindrical wire cage as the other choice. Ss were run for three days with reinforcement for either choice, a fourth day with food only in the feared box to test learning in conflict with avoidance tendency, and a fifth day with no reward in either GB to test extinction. Results showed (1) control rats avoided feared GB above chance expectancy; (2) adapted rats showed no avoidance and random choice in scores that were significantly different from controls; (3) a significantly greater number of alternations by E rats; (4) approach-avoidance conflict only by controls in the learning situation; (5) a return to a high percentage of alternation in the extinction situation only by the E rats.

Further experiments to investigate the mechanics of adaptation were discussed. An analogy was drawn between counterconditioning of the UCS and pure catharsis as experienced under hypnosis or narcosis.

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